REMARKS

In response to the Office Action mailed October 15, 2004, Applicants amend their application and request continued examination. In this Amendment claims 2-4 are cancelled and new claims 8-17 are added so that claims 1 and 5-17 are now pending.

Support for the amended and new claims is found throughout the patent application. New claims 8, 13, and 16 are derived from original claim 5 and new claims 11, 14, and 17 are derived from original claim 6, a claim stated to be allowable. New claims 10-12 are supported by the description in the patent application, particularly with respect to the Miller time period.

In the foregoing claims, the detection period is clarified. This clarifications is supported by the original disclosure for example, at pages 11 and 12 of the patent application, and the figures, including Figures 3 and 17, regarding changes in values of the gate voltage and gate current, respectively. As described in previous responses, in the presence of a short circuit of the power semiconductor device, the time required to reach a steady state is made shorter than in normal operation, for a number of the described embodiments. Because a detected voltage or current would reach the steady state value eventually, even in the presence of an abnormality, such as a short circuit, it is necessary to detect that the voltage or current has reached the steady state value early in order to detect the presence of a short circuit. The amended and newly submitted claims make this feature of the invention clearer.

In the Office Action mailed October 15, 2004, the drawings were objected to based upon the absence of separate "black boxes" for separately identified means of the claims. The amended claims do not include, as in the previously examined claims, a "controllable variable value detection means" and therefore the objection to the drawings is moot.

The rejection of claims 3 and 4 as indefinite is moot in view of the cancellation of those claims.

Formerly pending claims were rejected as anticipated by Fukuda et al. (U.S. Patent 6,717,785, hereinafter Fukuda). This rejection is not applicable to any claim now pending.

In Fukuda, an excessive current flow or a short circuit is detected by monitoring a current that flows from a sense terminal, element 4d in Figure 1 of Fukuda and element 51a in Figure 13 of Fukuda, of an insulated gate bipolar transistor (IGBT) through a resistor. The sense terminal is essential to the detection in Fukuda although, in that publication, an additional electrical value, for example the gate voltage, is measured. That additional measurement is used for changing the value of the detection resistor which includes resistors R1 and R2. These resistors are essential to correcting the accuracy of the detection of an abnormal condition.

Referring to Figure 13 of Fukuda, after a turn-on instruction is supplied, a transistor Tr1 is turned off and a transistor Tr2 is turned on for a period before the gate voltage reaches a threshold value. The transistor Tr2 short circuits the resistor R1 so that only the resistor R2 is present for detecting the sense current. When the gate voltage rises and exceeds a threshold voltage, the transistor Tr1 is turned on and the transistor Tr2 is turned off so that the detection resistor is actually the sum of the resistors R1 and R2. Because the resistor R2 is connected to the base terminal of a gate control transistor Tr3, that base terminal receives a voltage corresponding to the voltage drop across the combined resistors R2+R1. The gate voltage is detected in order to change the resistance of the detection resistor in accordance with the gate voltage, not to detect an excessive current or a short circuit through the gate voltage.

By contrast with Fukuda, in the invention as defined by the claims presented here, an abnormality, such as a short circuit, is detected solely based upon the gate voltage, gate current, or the charge supplied to the gate of the IGBT during turning-on of that IGBT. This feature distinguishes the invention from Fukuda and prevents anticipation of any pending claim by that publication.

Favorable consideration of the amended and newly presented claims is earnestly solicited.

Respectfully submitted,

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